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SCYPHOMEDUSAE OF KRUSADAI ISLAND

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(*Published September 1936*)

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The following notes on the Scyphomedusae of Krusadai Island are based on the desultory collections made from the locality by Dr. F. H. Gravely, Superintendent of the Government Museum, and on the few specimens obtained from the jelly-fish collection of the Madras Fisheries Department. I take this opportunity to thank Dr. F. H. Gravely for permitting me to study the collections and Dr. B. Sundararaj, Director of Fisheries, for allowing me to incorporate in this paper the Scyphomedusae collected by the Fisheries Department from Krusadai Island. I am also deeply grateful to Professor R. Gopala Aiyar, Director of the University Zoological Laboratory, for the constant help and encouragement I have received from him.

The entire collection contains only nine species and they are by no means representative. Excepting for three species of Cubomedusae the rest are Rhizostomae. The specimens are all in a bad state of preservation. Some of them are greatly mutilated while a few others present certain abnormalities in their structure.

Considering the number of species recorded from the Madras coast (Menon, 1930) the present collection is indeed very small. It has not brought forth any new species but is interesting in containing *Chiropsalmus quadrigatus*, Haeckel, which has not been recorded from Indian waters since Haeckel described it from Rangoon (1879).

The following is a list of the species in the collection :—

1 ? *Tamoya sp.*
2 *Chiropsalmus buitendijki*, Horst.
3 *Chiropsalmus quadrigatus*, Haeckel.
4 *Cassiopea andromeda*, Eschscholtz.
5 *Netrostoma coerulescens*, Maas.
6 *Mastigietta palmipes* (Haeckel).
7 *Crambionella orsini* (Vanhöffen).
8 *Acromitus flagellatus*, Stiasny.
9 ? *Rhopilema hispidum* (Vanhöffen).

The characters of the families and genera are not mentioned in these notes as they are given more or less in detail in 'The Scyphomedusae of Madras and the Neighbouring Coast' (Menon, 1930). Detailed descriptions of the medusae have also been omitted except in the case of species not recorded in that paper.

CUBOMEDUSAE.

Genus **Tamoya**, F. Müller, 1859.

? **Tamoya** sp.

One specimen 30 mm. high.

In this young specimen the stomach and manubrium are mutilated beyond recognition. Each pedalium is 14 mm. long axially and carries at its distal extremity bits of contracted tentacles. Inside the velarium there are five to six velar canals with outgrowths on their sides.

Genus **Chiropsalmus**, L. Agassiz, 1862.

Chiropsalmus buitendijki, Horst.

One specimen 40 mm. high.

This young specimen has all the pedalia intact but only two of them retain all the six branches. The tentacles at the extremities of these branches are all contracted.

Chiropsalmus quadrigatus, Haeckel.

One specimen collected by the Fisheries Department on 5th April 1928.

Haeckel's original description (1879) of the medusa collected from Rangoon (Indian Ocean) has since been augmented by Mayer's account (1910) of the specimens obtained from the Philippine Islands by the United States Bureau of Fisheries steamer *Albatross*. The following description is based on a single mutilated example whose distinguishing characters are the pedalia and the gastric saccules.

The bell is 100 mm. high, dome-shaped but with a flat top. The pedalia are present only in two of the interradii. At its place of attachment the pedalium is 20 mm. thick but distally it is thinner. It cannot be said that the pedalium is exactly flattened from side to side but it has longitudinal grooves along its entire length. The branches of the pedalium do not arise from the same level and some of them look longer than the others. The total length of the pedalium when measured ventrally is 70 mm. and the first branch is given off at about 20 mm. from the place of attachment. Of the two pedalia still present, one is branched ten times distally but none of these branches retain the tentacles. The velarium has entirely disappeared. The structure of the sense clubs could not be made out but the sensory niches have the same appearance as those of the specimens described by Mayer from the Philippine Islands. The stomach is also considerably damaged but the manubrium with its four lanceolate lips can be distinguished. The margin of these lips looks simple and entire. The gastric cirri are developed in large closely arranged tufts which mark out the borders of the stomach. The subumbrella saccules are present in two of the perradii and they have the typical cock's-comb-shaped appearance. Gonads are not noticeable in the present state of the specimen.

RHIZOSTOMAE.

Genus **Cassiopea**, Péron and Lesueur, 1809.

Cassiopea andromeda, Eschscholtz.

One specimen from the Fisheries Department and three from the Museum. The former and one of the latter are preserved in formalin and these have become brownish in colour. The two spirit preserved specimens seem to retain a trace of the original greenish tint.

The specimen collected by the Fisheries Department is 120 mm. in diameter and its bell is torn in several places. The margin, as usual, is not cleft into lappets. There are four velar lappets between a pair of rhopalar lappets. The arm disc is 55 mm. in diameter. Each arm measures about 90 mm. from its tip to the centre of the arm disc so much so that the tip of the arm projects beyond the umbrella margin. The branching of the arms conforms to the type found in the species, *C. andromeda* (Stiasny 1921, Pl. III, fig. 17). The appendages on the arms represent the two kinds figured by Stiasny (1921, p. 72, Text figs. 1 and 2). In addition there are others of a more slender build without any network of canals inside. The larger appendages on the arm disc are 15 mm. long and 3 mm. broad, while those on the arms are 15 mm. long and 6 mm. broad. In their present state all the appendages are flat and leaf-like. In every case the inner canal shows an enlargement just where it enters the appendage. The specimen is a male and there is no 'rosette' formed on the arm disc as in the female specimen described below.

The two spirit preserved specimens are of about the same size. The umbrella in both cases is very much crumpled up and as such it is very difficult to get an idea of the diameter of the bell. The arms measure 85 mm. from their extremities to the centre of the arm disc. The branching of the arms is as in the previous specimen and conforms to the type. The appendages on the arms and the arm disc are of two kinds, large and small, of which the latter are thickly developed on the arm disc forming a 'rosette' like structure. It is interesting to note that the smaller variety of appendages are practically absent from the arms while the larger ones are more or less evenly distributed on the arm disc and arms. At the centre of the arm disc there is a large appendage, 18 mm. long and 5 mm. broad, with a network of canals inside. The large appendages are broadest at about their middle region while their two extremities are tapering. The small, thin appendages met with on the arm disc are only 5 to 6 mm. long. They are developed in large numbers and constitute the 'rosette.' The gonads contain eggs. It is likely that the development of the 'rosette' has a sexual significance.

The fourth specimen is badly preserved and has taken a lot of rust along with other specimens preserved in a tin. The bell is 55 mm. across and looks absolutely flat with the mouth arms pressed on to its ventral side. The appendages on the arms are of the larger

kind and in their present state they are flat and triangular. Injection of Delafield's haematoxylin into these was not successful. The mouth frills are obscured and even to some extent reduced by the large number of appendages present on the arms. The specimen is a male but the gonads do not seem to have attained maturity.

It may be observed in passing that the arm disc in *Cassiopea andromeda* described above present certain interesting features. The two male specimens are without any 'rosette' on the arm disc, while both the female specimens have a crowded growth of the smaller type of appendages forming the 'rosette.' Similar growth of appendages has been observed in female specimens of *Lorifera lorifera* (Haeckel) where a thick cluster of stiff filaments constitute this structure. In *Netrostoma coerulescens*, Maas, the arm disc filaments have been observed to hold masses of developing eggs between them. All the above instances lend support to the suggestion that the 'rosette' is developed as a secondary sexual character in female specimens and probably functions in these cases as a sort of brood pouch for the developing larvae.

Genus **Netrostoma**, Schultze, 1898.

Netrostoma coerulescens, Maas.

There are eight specimens in the Museum collection and they all seem to be abnormally developed examples of the genus. It is with some hesitation, therefore, that they are referred to the species, *N. coerulescens*, especially as some of them are badly mutilated and their subumbrella canals obscured due to the absorption of rust from the tin in which they were packed.

Specimen 1.—The bell is about 50 mm. in diameter. The exumbrella is considerably wrinkled and is without any outgrowths on its surface. The margin is torn in many places. Only portions of the mouth arms are left. There are a few stiff appendages at the centre of the arm disc. The specimen is immature.

Specimen 2.—The margin of the bell in this is reflected on to the exumbrella which has a low dome of about 25 mm. diameter. A narrow furrow separates the dome from the bell margin. There are a few minute, papillary outgrowths scattered about on the exumbrella. The arms are not present. The diameter of the bell could not have been more than 50 mm. in the living condition.

Specimen 3.—The bell in this case is 90 mm. across. The central dome is low and smooth and has a diameter of 50 mm. The arm disc is also of the same diameter. Only five of the mouth arms are present and these do not extend to very much beyond the arm disc. Each arm is forked at the extremity. Rudiments of vesicular appendages are seen on the arms. In the central hollow of the arm disc there are numbers of wart covered filaments, some of which are interesting in being disproportionately long or short. The mouth frills do not extend on to the centre of the arm disc where the entire area is covered with a crowded

growth of filaments. Gonads carry large sized ova. Longitudinal muscles are powerfully developed. The subumbrella network has the usual structure met with in the species, *N. coerulescens*.

Specimen 4.—This specimen looks very much crumpled up and is only slightly smaller than the previous one which it resembles in the shape of the central dome. The large outgrowths present on the surface of the dome now look shrivelled up. The tips of the dichotomous branches of the arms extend to about the bell margin. The appendages on the arms are interesting in clearly showing the same structure as that of the stiff filaments on the arm disc. While on the arm disc these filaments develop into long and slender structures, on the branches of the arms they are reduced to stumpy vesicles. The mouth frills can be traced to almost the very centre of the arm disc, the thick growth of filamentous appendages noticed in the previous example being entirely absent here. But a few unusally long, stout and stiff appendages, scattered about on the arm disc, take the place of the thick growth of filaments. It may be pointed out that both these appendages have the same structure met with in *Netrostoma*. The difference in the size and flexibility of the two kinds of appendages both of which belong to the type of "Starre Anhänge" is understandable when it is seen that the more filamentous variety is developed in the female specimens, where they serve to hold the developing eggs between them. The present example is a male and naturally the appendages are not called upon to serve this function. A great reduction has taken place in the number of appendages while their size has increased considerably.

Reduction in the number of filaments and development of mouth frills to the centre of the arm disc have been noticed by the author in male specimens of *Mastigietta palmipes* (Haeckel). In females of this medusa the arm disc has a fairly thick cluster of filaments with little or no mouth frills. Stiasny has suggested that the medusae so far described under *Mastigietta* are likely to be only developmental stages or abnormally developed Leptobrachidae. Considering that all the specimens of *Netrostoma coerulescens* described in this paper are more or less abnormally developed examples the similarity in the structure and development of the arm disc filaments in these and in *Mastigietta* seems to be significant. In *Lorifera lorifera*, Haeckel, one of the Leptobrachidae and very likely the normally developed stage of one of the species of *Mastigietta*, the arm disc filaments are totally absent in males.

Specimen 5.—This specimen has the same size and appearance as the previous one. There are indications of large outgrowths having been present on the exumbrella. Ventrally the mouth frills do not reach to the very centre of the arm disc. Appendages are present on the arm disc. The specimen is a female.

Specimen 6.—The bell is about 75 mm. in diameter. The low dome on the exumbrella is without any warts or outgrowths. The bell margin is intact in some portions and there are 8 marginal lappets between a pair of sense organs. The specimen is a female and has a cluster of filaments, both long and short, on the arm disc.

Specimen 7.—This specimen is considerably mutilated, the arms having entirely disappeared. The bell is about 90 mm. across and has a large central outgrowth on it occupying an area of about 30 mm. in diameter. It looks as though this large outgrowth has been formed by the coalescence of a number of papillae. The exumbrella is otherwise smooth.

Specimen 8.—This is about 80 mm. in diameter and more or less like the previous one. But the central dome here is not clearly demarcated and the outgrowths are separate from one another. There are about ten of them and they are of different sizes. Mouth arms are entirely absent. Near the bell margin the meshes of the subumbrella network hold sand grains inside them.

Genus **Mastigietta**, Stiasny, 1921.

The genus was erected by Stiasny (1921) to include the interesting medusae described as *Crambessa palmipes,* Haeckel. They have great resemblance to the Leptobrachidae and it has been suggested that they are only developmental stages or abnormally developed Leptobrachidae.

Mastigietta palmipes (Haeckel).

Pl. I, fig. 2.

Of the two examples of this medusa in the Museum collection the larger one has been preserved along with several other jelly fishes in a rusty tin and has taken a lot of rust into its jelly making the animal look brownish. It has, however, retained traces of the characteristic deep violet colour on the marginal lappets. The bell is 70 mm. in diameter and in this respect it is by far the largest example recorded here. The exumbrella is covered with numerous nematocyst warts except on the lappet region which is very smooth and velvety. The bell margin is bent on to the subumbrella. There are eight rhopalia which are asymmetrically placed on the bell margin. Between a pair of rhopalia the velar lappets vary from five to eight. The narrow, pointed rhopalar lappets project longer than the velar lappets, whose tips alone are free. The marginal furrows demarcating the velar lappets are also not evenly disposed, so much so, that the lappets are not of the same size. Each side of the rectangular arm disc is 40 mm. Between a pair of the mouth arms the patagium is 13 mm. high. The mouth arms are all crowded together and some of them are twisted out of shape. They all lie towards the arm disc concavity obliterating the structures inside. The proximal undivided portion of the arm is considerably reduced, so much so, that the three-winged portion appears to be directly inserted on the arm disc. Abaxially the eight arms measure 17, 17, 22, 20, 17, 24, 22 and 18 mm., respectively. The arms have the usual structure. The two dorsal wings have secondary rows of mouth frills and inside the arms there are the typical double canals found in Leptobrachidae. On the subumbrella there are 12 to 14 canals between a pair of radial canals. The interradial canals are not always clearly developed centripetal to the ring canal. In one quadrant there is just an indication of it in the interradial angle of the stomach but soon it gets merged into the subumbrellar network. Gonads do not look mature but contain spermatocytes.

The second example is considerably smaller than the first. The bell is only 55 mm. in diameter and about 15 mm. high. The natural colour of the medusa has entirely disappeared and the animal looks pale yellow. The nature of the bell margin and the shape of the lappets, marginal and rhopalar, conform to the usual type. Of the eight rhopalia two are placed side by side with a single velar lappet between them. The arm disc is 25 mm. broad. The subgenital ostia are about two and half times the arm pillars. The mouth arms show an abnormality in being nine in number. A patagium is present. The lengths of the arms vary from 15 to 20 mm. The ventral concavity of the arm disc has a few filaments and well developed mouth frills.

Both the specimens are interesting in showing certain abnormal features. The rhopalia are irregularly placed on the bell margin and the mouth arms exhibit a tendency to grow into short, stumpy structures, although they are built on the same plan as the long strap-shaped mouth arms of *Lorifera.* The 'amethyst' spots noticed on the marginal lappets in one at least of the two specimens make it probable that the *Mastigietta* dealt with here are abnormally developed *Lorifera lorifera* (Haeckel).

Genus **Crambionella,** Stiasny, 1921.

Crambionella orsini (Vanhöffen).

Pl. I, Figs. 1 and 3.

The single mutilated specimen is abnormal in having nine mouth arms all of which are stunted in growth. The top portion of the bell as well as portions of the bell margin are greatly damaged. Some of the mouth arms are represented only by short stumps the major portions having been broken off.

The medusa is very much shrunk in the spirit in which it has been preserved. The bell might have been about 100 mm. in diameter. The nematocyst warts on the exumbrella are distinct only in some places. The lappet region is perfectly smooth. There are 16 velar and 2 ocular lappets in each octant of the bell. The ocular lappets are distinctly smaller than the velar lappets and do not project to the same level. The sense pits above the rhopalia are triangular in shape and contain furrows inside. The arm disc seems to have lost its natural shape. The subgenital ostia are crescentic slits. The inter-ostial pillars are a little more than twice as broad as these slit-like openings. As mentioned above the mouth arms look stunted. The proximal undivided portion of the arm is 10 mm. and the entire three-winged portion with its naked extremity is only 55 mm. On the ventral aspect, the mouth frills are developed almost to the very tip of the arm. The two dorsal rows, however, stop at about the middle region of the arm, leaving a naked, triangular area which represents the long, naked terminal appendage met with in normal individuals. The canal system inside the arm conforms to the usual type. The appendages on the arms are flat and orbicular

and in their present state look like flaps covering the mouth frills. The appendages are more numerous on the abaxial portions of the arms. Nematocysts are present on the surface of the appendages.

Genus **Acromitus**, Light, 1914.

Acromitus flagellatus, Stiasny.

Of the two specimens the younger one has got considerably shrunk in formalin and some of its characters have become indistinguishable due to rust having got into the jelly along with some other specimens that have shared the same fate. The larger specimen is 90 mm. in diameter and the bell in its present condition looks flatter than a hemisphere. The exumbrella has numerous very minute nematocyst warts. There is only one large, prominent papilla in each of the four subgenital ostia. The bracket-like outgrowths of the arm disc projecting into the subgenital ostia are prominent on two sides. The terminal filaments of the mouth arms are very thick proximally but towards their distal extremities they become thinner and for about half their lengths have a uniform thickness. The length of the longest filament is 100 mm. The accessory filaments on the mouth arms are short, slender and very inconspicuous. In a single instance, however, one of the filaments has attained more or less the same size as the terminal filament.

Genus **Rhopilema**, Haeckel, 1879.

? **Rhopilema hispidum** (Vanhöffen).

One young specimen in the Museum collection with a label bearing the date 26th September 1922 and a larger one collected on 14th August 1928 by the Fisheries Department.

Both the specimens are considerably mutilated. The younger one has an incomplete bell and is without any trace of the mouth arms. The larger specimen has also lost all its mouth arms.

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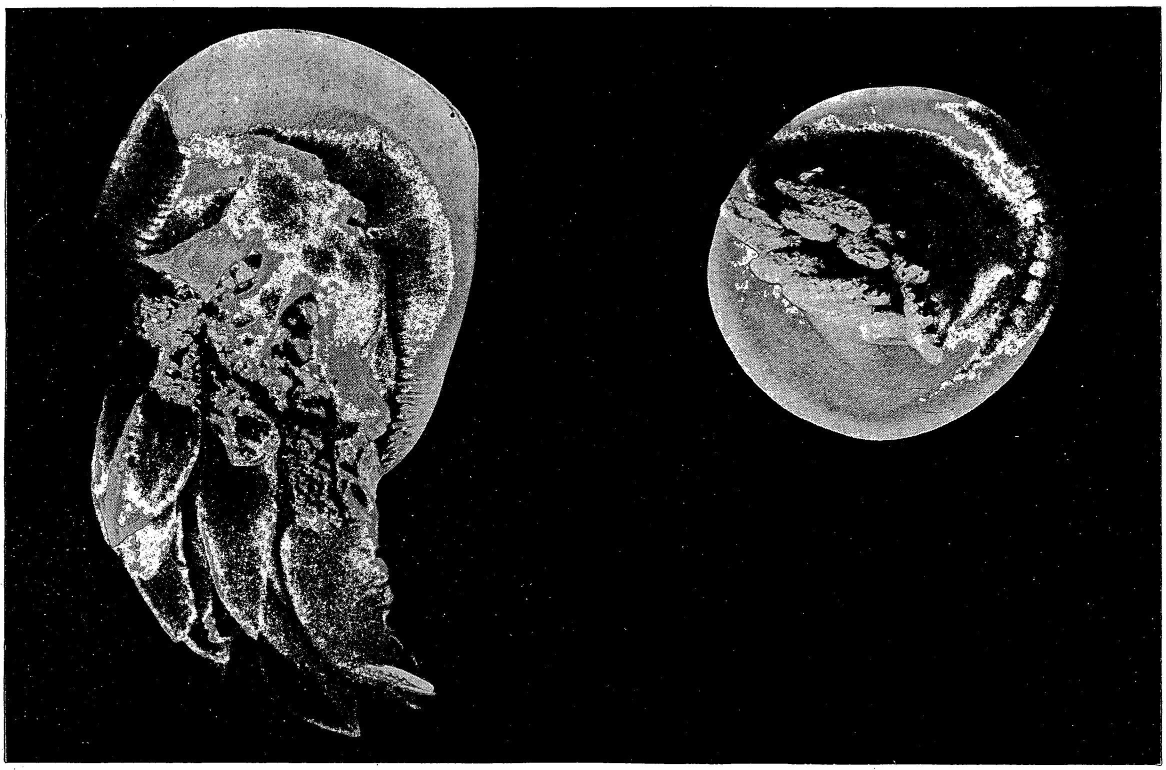
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PLATE I.

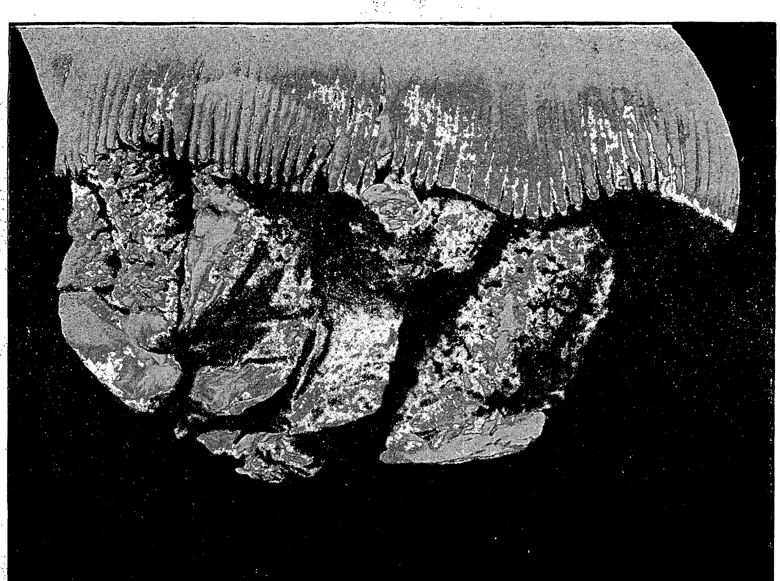
Figure 1. *Crambionella orsini*—Normal specimen from Madras.

,, 2. *Mastigietta palmipes.*—A specimen 55 mm. across from Krusadai Island.

,, 3. *Crambionella orsini.*—Abnormal specimen from Krusadai Island.



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